

HIGHLY CONFIDENTIAL SUBJECT TO PROTECTIVE ORDER CMB 1651

P-1080

MASTERCARD INTERNATIONAL

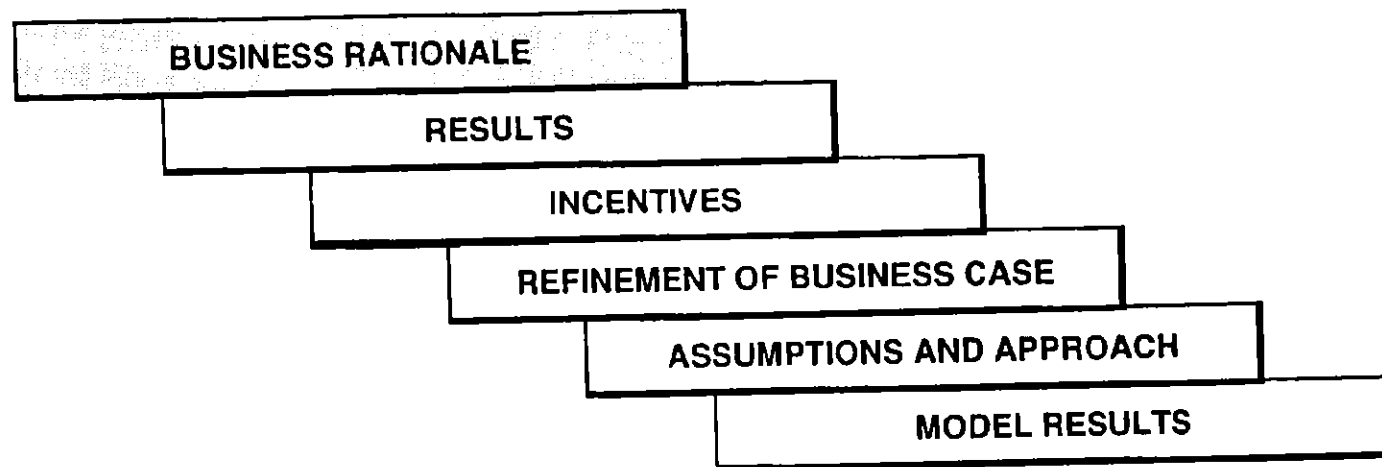
BUSINESS CASE OVERVIEW FOR CAM/CVM IN THE UNITED STATES

January 5, 1994



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***Members cannot continue to sustain
existing levels of fraud and credit losses***

**BUSINESS
RATIONALE**

1992 fraud losses in the U.S. exceeded \$335 million (0.24% of sales volume)

- Overall fraud losses are projected to remain above 0.20% of sales volume, even after implementation of improved card delivery/card activation programs
- Despite authorization levels of 85% to 90%, pre-status fraud continues to grow (about 80% of total fraud)

Counterfeit fraud losses are the fastest growing segment of fraud worldwide

1992 credit losses in the U.S. totaled over \$4 billion, and have shown some downward trend in 1993. Issuers need to maintain control over the cardholder abuse portion of credit losses (amounts over limit and transactions on statused accounts)

Implementation of a Chip card will help to control both fraud and credit losses

- Use of a Cardholder Verification Method (CVM) will reduce pre-status and below floor limit fraud
- Use of a Card Authentication Method (CAM) will reduce counterfeit fraud
- Use of Issuer-defined parameters programmed into the Chip will help to control the portion of credit losses due to overlimits and statused accounts

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***Use of a CVM will help to reduce
pre-status and below floor limit fraud***

**BUSINESS
RATIONALE**

High authorization levels do not adequately control pre-status fraud ← 80/80% is pre-status - high?

- Fraudulent activity occurring prior to Issuer notification is difficult to identify, even with costly and sophisticated profiling systems
- A method is required that identifies the cardholder as genuine to prevent fraudulent usage prior to an account being statused

PIN as a Cardholder Verification Method (CVM) is a reasonable solution for implementation this decade

- Signatures and photo-on-card techniques are not sufficiently effective long term
- PIN is already in use worldwide for ATM access and, in some markets, at the point of sale
- Other CVM techniques (e.g. biometrics) are not yet feasible in the point of sale environment

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***Protection against counterfeit fraud in ATMs
and at the point-of-sale must be ensured in order to
maintain public confidence in the retail banking system***

**BUSINESS
RATIONALE**

Unauthorized access to checking account balances by means of counterfeit debit and credit cards could undermine public trust in the use of plastic payment products

- Although actual losses to date have been relatively modest, the number of cases is increasing
- Widespread use of PIN as a CVM at the point of sale could make the ATM network even more vulnerable to counterfeit fraud unless a secure Card Authentication Method (CAM) is implemented

Use of the Chip as a CAM protects against counterfeit fraud attacks and protects the industry from unnecessary public scrutiny due to "phantom withdrawals"

- Although the current Chip being considered does not *eliminate* counterfeit fraud (static authentication of below-floor limit transactions [DES]), this risk is considered an acceptable business risk
- Further, Chip technology provides the capability to migrate to dynamic authentication of all transactions (RSA) once this capability becomes cost effective

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***Use of Issuer-defined parameters in the
Chip will help to control the portion of credit
losses due to overlimits and statused accounts***

**BUSINESS
RATIONALE**

The Chip can be programmed with Issuer-defined parameters unique to each cardholder

- A *transaction counter*, controls the number of transactions which can be processed off-line before an on-line authorization request is initiated (also referred to as a "1 in N" parameter)
- A *cumulative value counter*, controls the total value of transactions which can occur on a card before an on-line authorization request is initiated
- Any other Issuer-defined decision criteria, which can be based on transaction data captured when the card is in use

The programming of Issuer-defined parameters provides increased Issuer risk control and a more intelligent use of on-line authorizations

- Transaction counter: provides control over fraudulent transactions and some credit losses which occur below Retailer floor limits
- Cumulative value counter: provides control over Cardholders' exceeding their credit limit (plus an expansion factor)
- These "cardholder floor limits" generate more intelligent requests for on-line authorizations. This reduces the need for the Issuer to see a high number of low risk transactions

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***Magnetic-stripe technology to support
CAM and CVM applications is being evaluated
but is yet to be successfully proven in the marketplace***

**BUSINESS
RATIONALE**

Use of the magnetic-stripe based CAM/CVM requires a fully on-line environment because the Issuer must match the watermark values (CAM) and the PIN (CVM)

- In high communication cost environments, such as Europe, an on-line approach is very costly
- Issuers in the United States are also challenging the costs/benefits of a fully on-line approach, (some have concluded that zero floor limits *are not* cost effective)

The static nature of a magnetic-stripe CAM is more prone to emulation attacks than a Chip-based CAM

The opportunity to migrate to biometric CVM techniques (e.g., dynamic signature verification) would be more costly in a magnetic-stripe environment (identification verified on-line) than through use of a Chip (identification verified off-line)

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***Use of a Chip provides strategic benefits
in addition to risk control which cannot be
accomplished with magnetic-stripe technology***

**BUSINESS
RATIONALE**

The Chip allows a broad range of financial services and products to be supported on a single card

Many banks and non-banking companies throughout the world have executed or are contemplating the use of Chip cards to offer new products

- Stored value cards: Denmark, Portugal, Australia, UK (Mondex), USA (AT&T/Chemical Bank)
- Frequent user programs: Germany (Lufthansa)
- Telephone cards: Germany, France, Switzerland
- Retailer Data Base/Consumer Reward programs: USA (Bank One)

It is important that the card associations and their members take action to control ownership of the Chip

- Ensures the security and cross-border interoperability of Chip card-based applications
- Allows the banks to maintain control over a critical aspect of the retail payments business

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***Implementation of the Chip provides the
MasterCard membership with a means of enhanced
risk control and the delivery of new products and services***

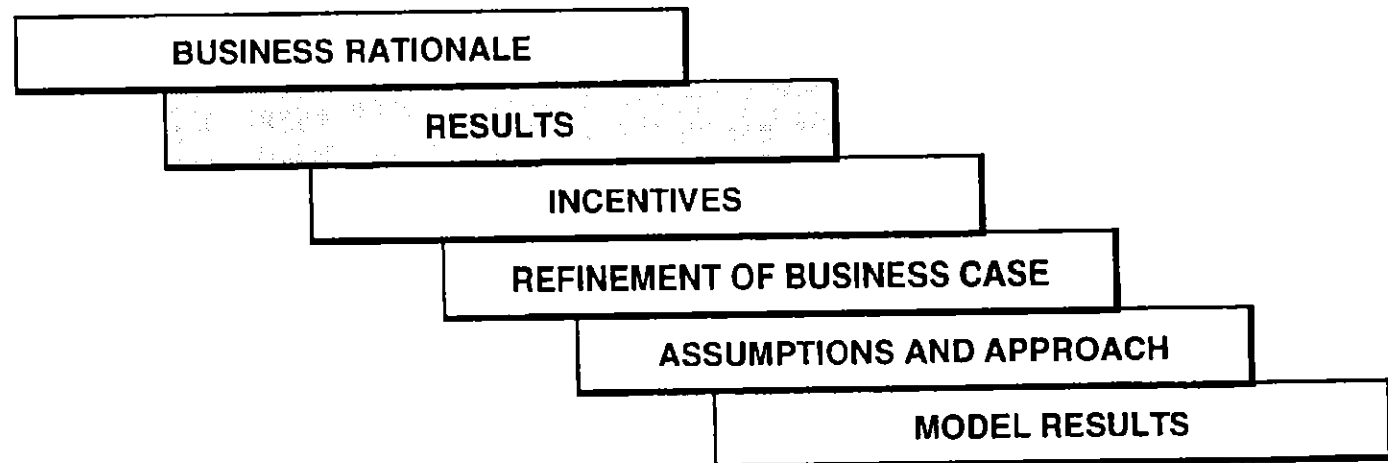
**BUSINESS
CONCLUSION**

- ✓ Chip as a CVM (PIN) platform to cost-effectively control pre-status fraud (PIN is verified off-line)
- ✓ Chip as a CAM to control counterfeit losses and maintain public confidence in the retail banking system
- ✓ Chip as a targeted authorizations mechanism to control credit overlimits and losses on statused accounts
- ✓ Chip as a CVM and CAM platform for all MasterCard products
- ✓ Chip as a platform to offer additional products and services on a single card

Implementation of the Chip in the U.S. is consistent with the direction of the MasterCard/Europay membership worldwide

- France has successfully implemented the Chip card for all its plastic payment products
- Europay International and its European members have endorsed Chip as the platform for all Europay products
- Use of the Chip and the resulting systems requirements will be incorporated into the development of "Programme Global"

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**Implementation of the Chip card as a CAM/CVM has
an attractive business case solely on the basis of improved
risk management control and operations costs savings**

RESULTS

SUMMARY BASE CASE RESULTS

(In \$ millions)

	CHIP as CAM/CVM	
	Cumulative 7 Year*	Annual On-Going**
Costs		
Incremental Card Costs	458	65
Terminal Upgrade/Conversion	250	10
Program Administration	168	2
Total Costs	876	77
Benefits		
Reduced Fraud Losses	1,129	249
Reduced Credit Write-offs	66 ⁺	12
Reduced Processing Costs (auth) 60% auth	439	106
Reduced Risk Management Program Costs	210	45
Total Benefits	1,844	413
Net Benefit	969	336

* Cumulative-costs and benefits for the first seven years of operation

** On-going annual costs and benefits following complete conversion

+ In a 60% auth level environment, credit is likely to be cost, not benefit (my view)

Assumes terminal deployment focused on high-risk areas¹⁰ -

10% replacement rate

not discounted; no inflation

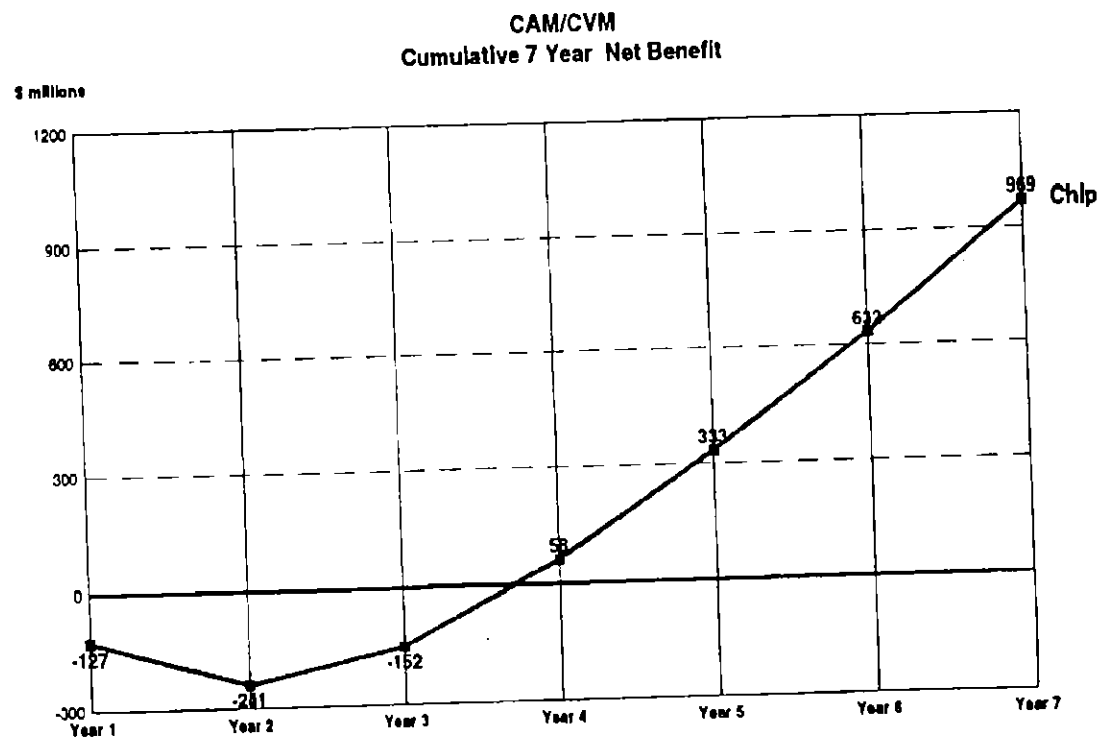
15% replacement rate

fraud initiatives

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RESULTS

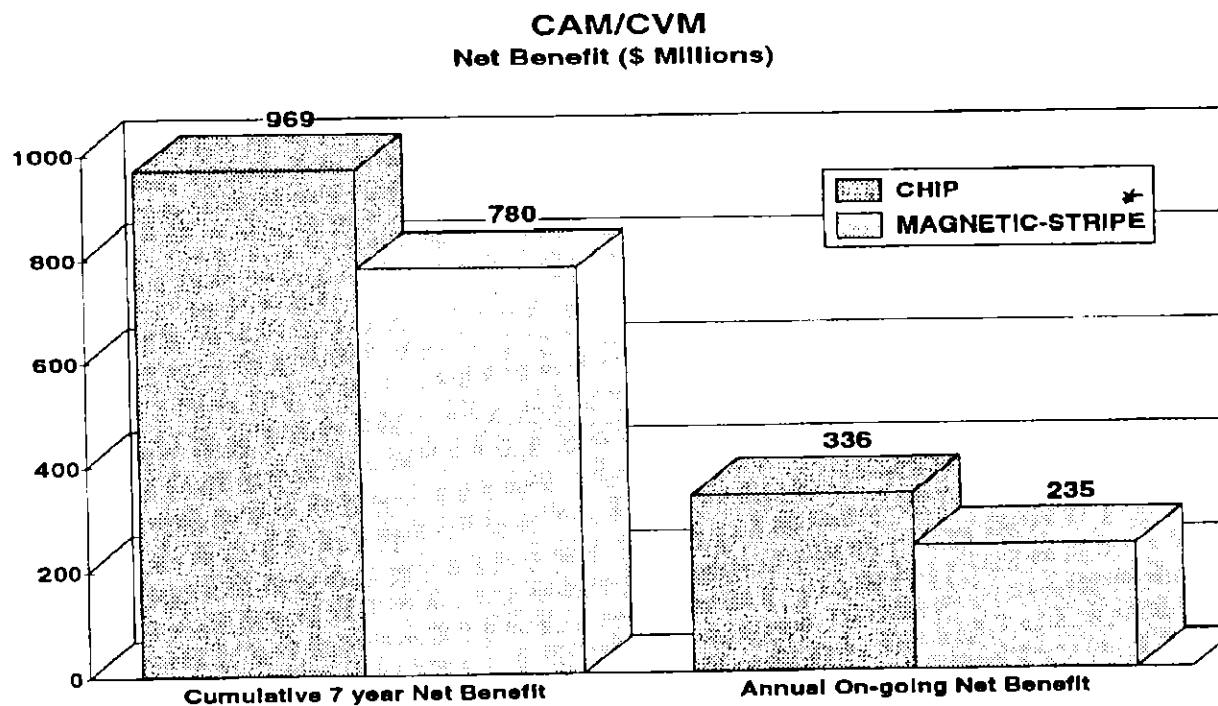
*The payback period for Chip card as a
CAM/CVM in the U.S. is between three and four years*



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Further, Chip as CAM/CVM has a better case than Magnetic stripe as CAM/CVM under current base case assumptions

RESULTS



The Chip card business case will be even more attractive with the addition of Value Added Services. Mag-Stripe CAM/CVM is less attractive primarily due to higher authorization costs more than offsetting the higher chip costs

* Card cost = \$.07

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The economic results are particularly sensitive to incremental card costs and on-line authorization levels

RESULTS

The incremental cost of the Chip card is significantly higher than for magnetic-stripe cards

Barclay's says we can't get a chip with required functionality at this cost (esp. cross-border capability)

- Incremental cost consists of the microchip, chip embedding, and personalization
- Incremental Chip card cost of \$1.60 in year 1, declining to \$1.00 in year 7, versus a mag-stripe incremental cost of \$0.07
- A scenario where chip costs decline from \$3.00 (current French cost) to \$2.00 over 7 years produces a 7 year business case that is still positive (\$410 million versus \$969 million in the base case)

Reducing authorization levels, through a combination of higher floor limits and more intelligent authorizations, dramatically increases net benefits and should be considered as part of a chip strategy

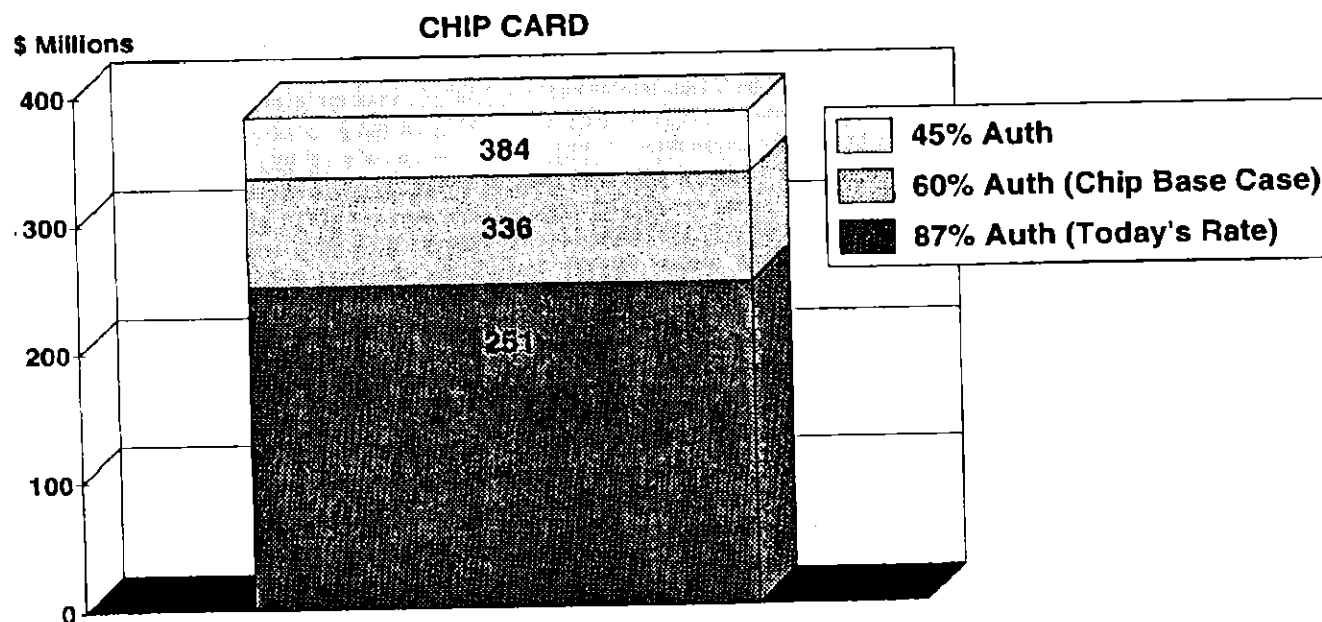
- The base case Chip CVM/CAM scenario (whose numbers are shown in this report) has authorizations declining from current levels of 87% to about 60% over time (equivalent to a \$25 floor limit)
- Because the off-line CVM and CAM reduce fraud, and card parameters automatically generate a request for authorization when they are exceeded, overall risk control can be maintained with lower levels of on-line authorizations (e.g., raising of Retailer floor limits can be justified)
- "1 in N" transaction and cumulative value counters in the chip enable more intelligent authorizations for below floor limit transactions
- Card data authentication and PIN verification take place off-line

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*Lowering authorization rates from
today's levels due to Chip capabilities increases
the attractiveness of the Chip card business case*

RESULTS

CAM/CVM Annual On-going Net Benefits
(With Chip at various authorisation levels)

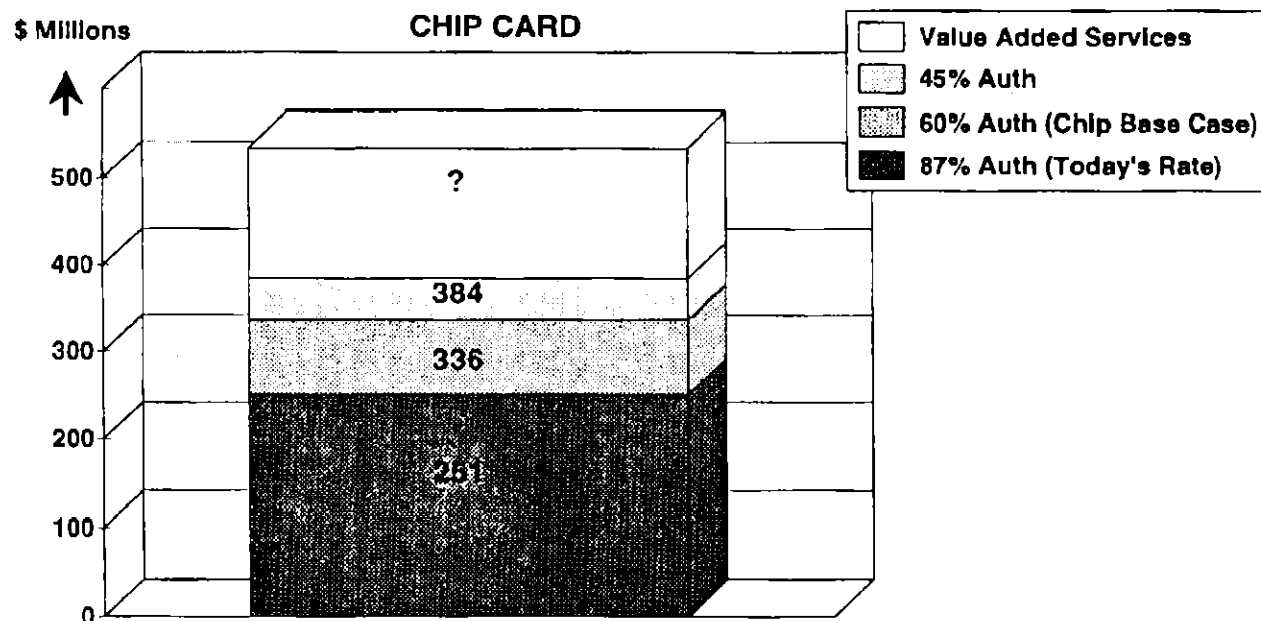


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*Offering value-added services on the
Chip card, although not yet quantified, is
likely to produce significant additional benefits*

RESULTS

**CAM/CVM Annual On-going Net Benefits
(Addition of Value-Added Services)**

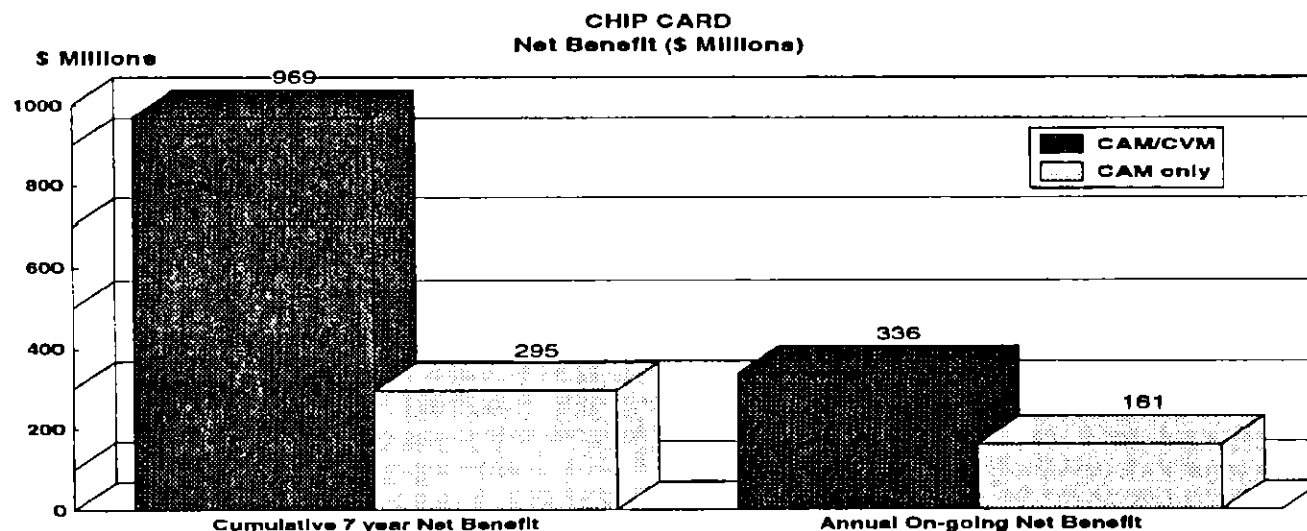


- In contrast, Mag-Stripe technology is limited in its ability to offer Value Added Services

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*In contrast to CAM/CVM, a CAM
only scenario is much less attractive*

RESULTS



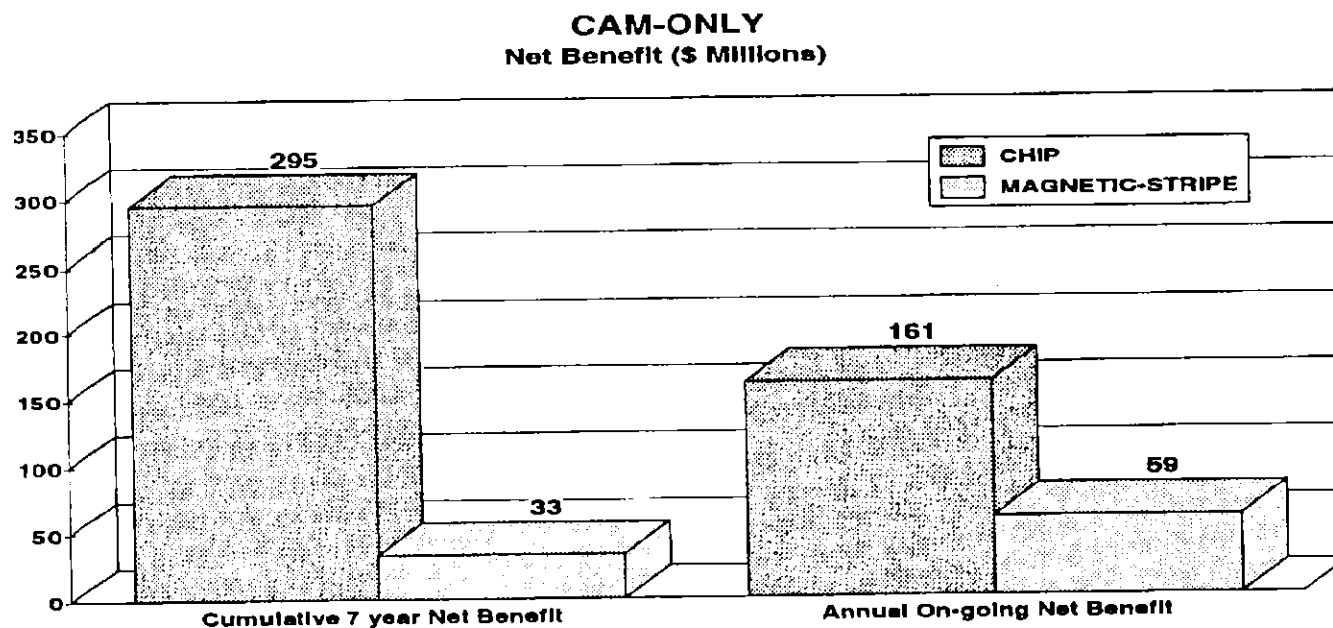
However, a CAM-only scenario does have a positive case for the following reasons

- Counterfeit fraud is controlled
- Partial control of post-status Lost/Stolen and Card Not Received fraud is provided by the cumulative value and "1-In-N" transaction counters
- Counters also allow for reduction in authorization levels without degradation of risk controls
- Limited incremental Credit Loss control is provided by the same counters

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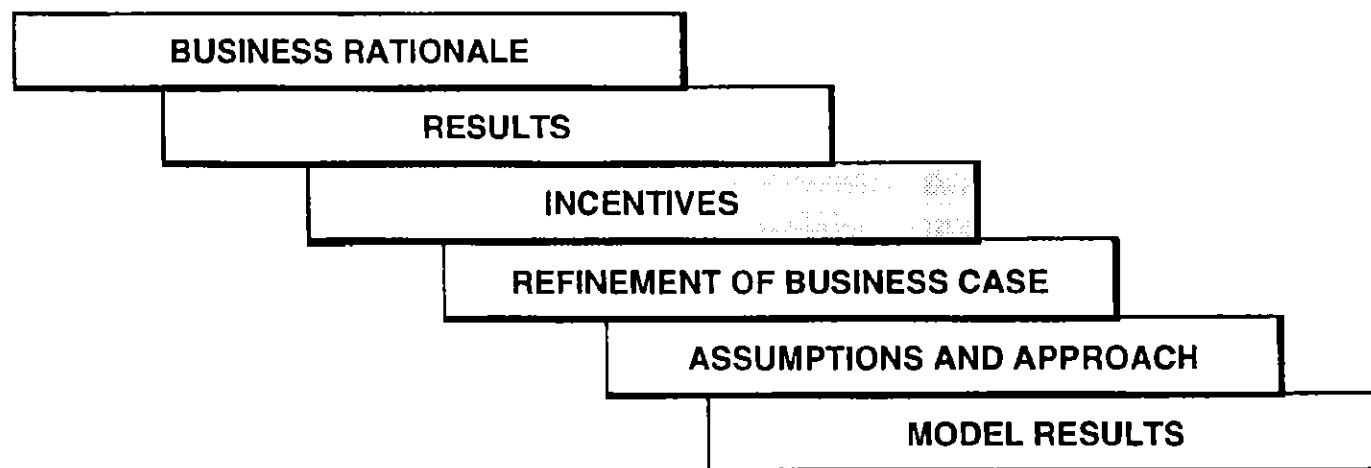
*In the CAM-Only scenarios, Chip is
also more attractive than Magnetic Stripe*

RESULTS



- The chip CAM-Only strategy includes cumulative value and 1-in-N counters which would allow for authorization reductions and limited incremental credit loss control
- Mag-Stripe Cam-Only does not accrue these benefits because authorization levels are not changed from "do nothing" levels

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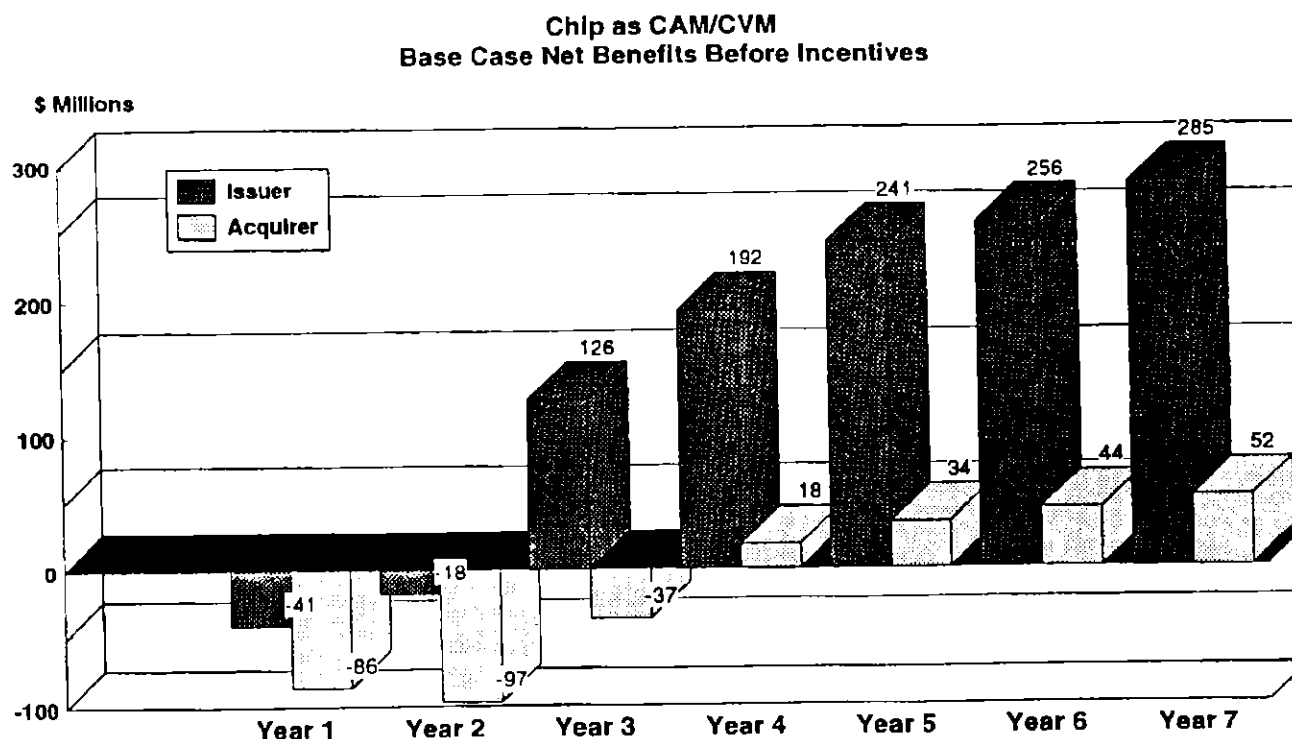


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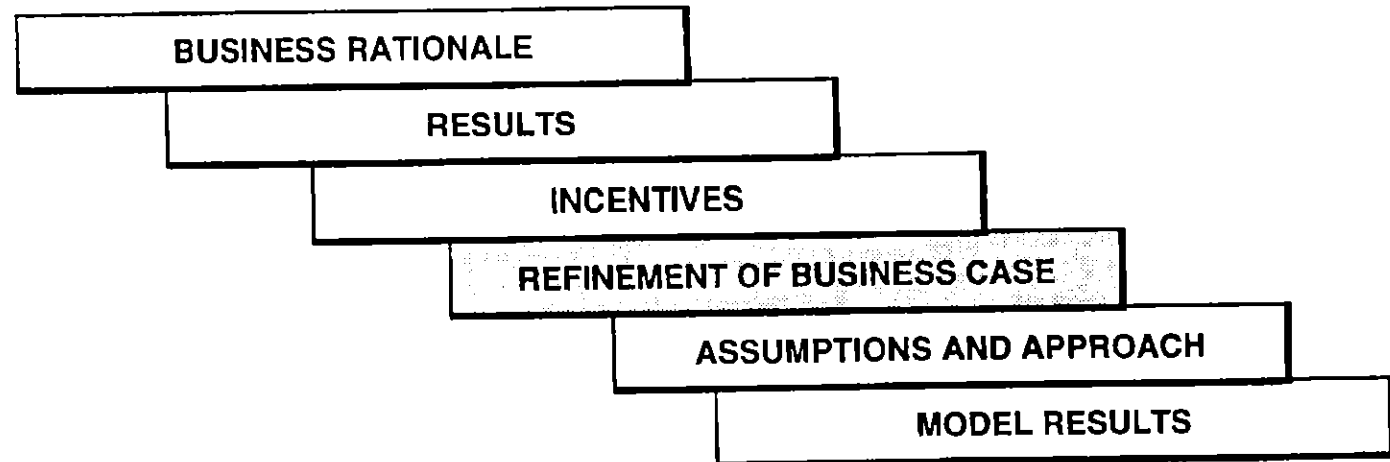
Benefits accrue primarily to Issuers and are sufficient to fund the investment required by Acquirers and Merchants; however, the methodology to fund the investment requires additional consideration

INCENTIVES



Issuer benefits resulting from value-added services would provide upside revenue potential to that shown above

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***As MasterCard moves forward with
Chip card planning activities, the following
implications of the Business Case must be further evaluated***

**REFINEMENT OF
BUSINESS CASE**

Implication	Comment
<ul style="list-style-type: none"> Will PIN requirement lead to permanent cardholder attrition? How significant is this risk? 	<ul style="list-style-type: none"> Card attrition (consolidation) is more likely than cardholder attrition. Impact on transaction volume likely to be small Attrition can be minimized by the following: Issuer capabilities to allow Cardholders to self-select PIN; making PIN mandatory at the POS; and Issuer retention programs Consumer market research should be conducted to assess risk of attrition and to identify actions to control it
<ul style="list-style-type: none"> What implications will Chip card have on existing authorization strategies? 	<ul style="list-style-type: none"> Preliminary analysis indicates that optimal floor limits could be even higher than \$25 (yielding a 60% authorisation rate) used in the Business Case Further analysis will require sampling of fraud and credit risk files
<ul style="list-style-type: none"> What method(s) should be used to promote retailer incentives required for Chip implementation? 	<ul style="list-style-type: none"> Issuer incentives are sufficient to fund the investment, although methodology has not been developed Methodologies should be explored in concert with Issuer and Acquirer members, potentially with input from retailers

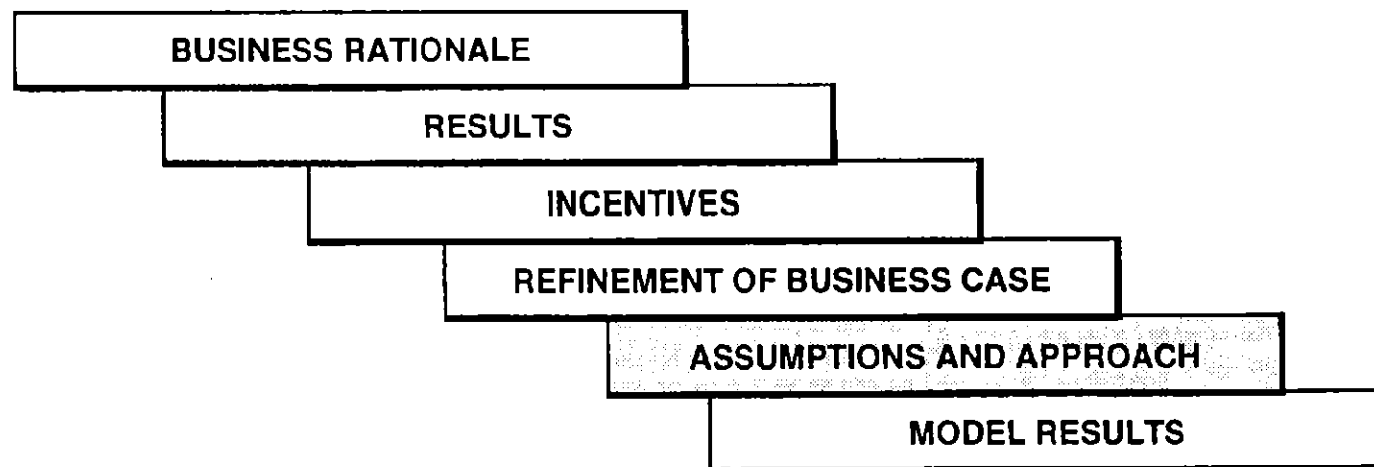
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As MasterCard moves forward with Chip card planning activities, the following implications of the Business Case must be further evaluated . . .

**REFINEMENT OF
BUSINESS CASE**

Implication	Comment
<ul style="list-style-type: none"> What will be the impact on Interchange Fees of a Chip Strategy 	<ul style="list-style-type: none"> Pro-forma estimates should be made and reviewed with members Fee impact should be considered in connection with development of other incentives to motivate retailer cooperation
<ul style="list-style-type: none"> Can MasterCard and Visa successfully cooperate on a common chip card strategy at the point of sale 	<ul style="list-style-type: none"> Both associations must actively support the introduction of Chip Discussions already underway to develop specifications to ensure common acceptance at POS Assurances of timely cooperation will require active attention of senior executives from member organizations

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A comparative Business Case was developed to evaluate implementation of Chip versus Magnetic-stripe technologies

**ASSUMPTIONS
AND APPROACH**

Evaluation of costs and benefits uses a "Base Case" approach

- Base Case is a "do nothing" scenario. It forecasts turnover, transaction volumes, risk and other costs in an environment with no CAM/CVM
- Different CAM/CVM scenarios are developed and compared against the Base Case to determine incremental benefits and costs associated with implementation

Four CAM/CVM scenarios have been evaluated

- | | |
|---------------------------------------|--|
| 1. Chip as CAM with PIN as CVM | 3. Magnetic Stripe as CAM with PIN as CVM |
| 2. Chip as CAM-only (no CVM) | 4. Magnetic Stripe as CAM-only (no CVM) |

The model quantifies benefits associated *only* with CAM and/or CVM. Potential benefits from new products or "value added" services which could be delivered on a chip platform are not included

Certain other cost savings would occur with CAM/CVM implementation (e.g. chargebacks, NRI program costs, neural networks, fraud investigation, etc.). These savings have not been quantified but would further enhance the business case.

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***The Business Case is based on a
projection of costs and benefits over a
seven year period (the average life of a POS terminal)***

**ASSUMPTIONS
AND APPROACH**

Results are presented in "real" terms (not adjusted for inflation).

A discounted cash flow analysis has not been undertaken

Non-recurring infrastructure costs (POS terminal upgrade costs, Issuer and Acquirer systems, and so forth) are shared 50/50 between MasterCard and other card programs since a common solution at the point-of-sale will be required. (It could be argued that MasterCard portion should be lower given its market share)

Benefits and costs have been segregated between Issuers and Acquirers in order to understand program funding and incentive implications

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Chip scenarios assume the use of a microprocessor chip with issuer-defined parameters to control fraud and credit losses, as well as reduce authorization levels

ASSUMPTIONS AND APPROACH

Major assumptions for Chip scenarios are outlined below:

CATEGORY	ASSUMPTION
Incremental Card Cost	\$1.60 declining to \$1.00 over five years, constant thereafter
Card Conversion	Majority converted in first three years, then in two year reissue cycles
Issuer-defined Parameters	"1 in N" transaction counter and cumulative value counter to initiate requests for on-line authorization
Authorization Rates	Reduce rates from current level of 87% to about 60% by year 7
POS and ATM Terminal Conversion	100% conversion over four years
Fraud Loss Reduction	<ul style="list-style-type: none"> Use of PIN to reduce majority of Lost & Stolen Fraud Use of Chip as CAM to reduce majority of Counterfeit Fraud Use of Issuer-defined parameters to control post-status fraud where PIN is compromised
Credit Loss Reduction	Use of Issuer-defined parameters to control overlimits and losses on statused accounts
Risk Management Program Cost Savings	Costs saved, primarily in fraud investigation, as fraud levels decline
Systems and Administration	\$170 million to cover cardholder and merchant education (primarily related to PIN) and additional equipment and system modification costs to accommodate Chip communications

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Magnetic-stripe scenarios assume the technology (e.g. Watermark) has been successfully tested and that POS equipment is commercially available within the same time frames as the Chip

ASSUMPTIONS AND APPROACH

Major assumptions for Magnetic-stripe scenarios are outlined below:

CATEGORY	ASSUMPTION
Incremental Card Cost	\$0.07 per card
Card Conversion	Majority converted in first three years, then in two year reissue cycles
Authorization Rates	<ul style="list-style-type: none"> 100% on-line authorization levels required to verify PIN Base Case authorization levels for CAM only scenarios (i.e., CAM verified on above the floor limit transactions only)
POS and ATM Terminal Conversion	100% conversion over four years
Fraud Loss Reduction	<ul style="list-style-type: none"> Use of PIN to reduce majority of Lost & Stolen Fraud Use of Mag-stripe as CAM to reduce majority of Counterfeit Fraud 100% authorization levels (CVM/CAM scenarios only) to further control post-status fraud
Credit Loss Reduction	100% authorization levels (CVM/CAM only) controls portion of credit losses from over limit and statused accounts; no incremental benefit for CAM only scenarios
Risk Management Program Cost Savings	Costs saved, primarily in fraud investigation, as fraud levels decline
Systems and Administration	\$140 million to cover cardholder and merchant education (primarily related to PIN) and system modification costs to upgrade Retailer networks to protect CAM values that are sent "in the clear"

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APPENDIX

DETAILED ASSUMPTIONS

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The model structure is the same for all four implementation scenarios. However, the inputs, as well as the cost/benefit formulas, can be different for each option

All Chip scenarios assume that a standard magnetic stripe coexists on the card for use in non-chip converted terminals

CATEGORY	ASSUMPTION	SOURCE/COMMENTS
Transactions per Card per Year Base Value (1994) Growth rate	16.6 (POS & ATM) Zero	Source: JoAnn Berger, MCI Marketing Stats MCI stats show a 5% annual rise in txns per card over the previous 2 years; however it is assumed increased use of debit cards will restrict growth in credit card transactions
Average Transaction Value (ATV) Base Value Growth rate	\$80.40 (POS & ATM) 1%	Source: Tom McGrath, JoAnn Berger (MCI) = \$80.40 with 3% growth 3% growth includes inflation. Base Case assumes 2% inflation rate, bringing real growth to 1% per year
Number of MasterCard Base Value Growth rate	106 million 6% growth in Year 1, declining to 2% by Year 6	Source: Tom McGrath (MCI); assumed 6% all years, based on previous growth rates of 8% over last two years Despite historical growth rates, Base Case assumes 6% growth is not sustainable over the entire projection period, and is gradually reduced
POS Terminals Base Value Growth rate	1.3 million, not broken down by type 4% annual growth beginning in 1995	Source: P.A. Consulting (conveyed through Tom McGrath). Source is apparently Nilson

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CATEGORY	ASSUMPTION	SOURCE/COMMENTS
ATM's		
Base Value	70,561 ATMs accepting MasterCard and Cirrus	Source: JoAnn Berger (MCI)
Growth rate	4%	EDC assumed 4% annual growth starting in 1995. Same as for POS
Fraud		
Percent of Sales Volume	0.20%; zero growth	Source: Joy Goldsmith, MasterCard Security; (Shift in fraud type assumption EDC)
Percent of Fraud by Type	<u>U.S. Issuer Fraud by Type of Fraud: Shift per Year</u> MO/TO 14.0% Lost/Stolen/Other/App. 50.1% NRI 17.4% - 1% Per Yr. Counterfeit 18.3% + 1% Per Yr. Multiple Imprint 0.2%	<u>Fraud Losses (as a % of turnover):</u> <ul style="list-style-type: none"> • 0.24% 1992 • 0.22% first quarter 1993 • New fraud control programs are keeping absolute fraud flat (declining as a percent of turnover) • EDC assumption: 0.20% in 1994 in anticipation of CVC, and left it constant as a % of sales (which grow)
Percent of Fraud by Acquiring "Area"	<u>U.S. Issuer Fraud Acquired by Following Areas:</u> U.S. 86.7% Germany 0.8% UK 0.8% France 0.2% Other Europe 0.8% Rest of World (e.g. Asia) 10.7%	<u>Shift within Fraud Types:</u> MasterCard expects marginal counterfeit growth at the expense of NRI; 0.1% change for each per year; EDC assumed 1% shift based on other Issuer data
Credit Losses as % of Sales Volume	2.50% of Total Sales Volume, for all years	Source: JoAnn Berger (MCI). Provided sales volumes (POS + ATM) as well as credit loss figures (credit losses + bankruptcy) by quarter for 1991 through mid-year 1993 Note: Trend is moving down from 3.1% in 1991, 2.9% in 1992, 2.5% in first half 1993

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CATEGORY	ASSUMPTION								SOURCE/COMMENTS
Authorization Rates		YR 1	YR 2	YR 3	YR 4	YR 5	YR 6	YR 7	Source: Tom McGrath, (from MCI Marketing Stats Dept.) for Base Case assumptions. EDC assumed rates for each implementation scenario
Base Rate		87%	88%	89%	90%	91%	92%	93%	
Implementation Scenario for Converted Cards/Terminals	Chip CAM/CVM	87%	70%	60%	60%	60%	60%	60%	Note: Authorization rates for each scenario apply only to transactions resulting from converted cards used at converted terminals
	Chip CAM-only	87%	70%	60%	60%	60%	60%	60%	
	Mag-stripe	100%	100%	100%	100%	100%	100%		The authorization rate applied in the model is a blend of this rate and the base rate (above), based on the progress of converting cards and terminals
	CAM/CVM	100%							
	Mag-stripe CAM only	87%	88%	89%	90%	91%	92%	93%	
% International Transactions	1.2% of transactions from U.S. issued card take place outside of the U.S. (and incur international switching fees if authorized). Assumed Europe represents 50% of the total								Source: Bob Schmid (MCI): 1992 intl. volume = 1.1 - 1.3%
PIN Effectiveness	75% increasing to 85% by year 5, then level								The percent of Lost or Stolen cards that would not have their PIN compromised due to cardholder writing PIN on or near the card Source: EDC assumption based on French experience, UK market research, PIN self select and growing cardholder familiarity over time

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CATEGORY	ASSUMPTION	SOURCE/COMMENTS
Credit Loss Savings Over Limit Statused Accounts	<p>5% of Credit Losses are represented by transactions which exceed the credit limit (plus expansion factor)</p> <p>2.5% of Credit losses are represented by transactions which occur on an account after it has been statused</p> <p>However, it is estimated that only 0.50% of total credit losses can be saved (0.60% in Mag-Stripe CVM/CAM) due to Issuer approval of authorizations</p>	<p>Source: EDC Assumption</p> <p>Mag-stripe scenarios will reduce a fraction of these losses due to 100% on-line authorization rates. Chip scenarios will reduce a fraction of Over Limit losses and a smaller fraction of Statused Account losses due to cumulative value and transact'n counters</p> <p>Note: Both reduction amounts are not 100% of the Over Limit and Statused Account total, as it is assumed that Issuers will fail to decline most transactions that fall into these categories when given the opportunity. (Based on 7.5% losses in these categories today in an 87% authorization environment)</p> <p>Note: The reduction amounts (0.50% and 0.60%) are listed at their gross levels, but are only applied when a converted card is used in a converted terminal</p>

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CATEGORY	ASSUMPTION	SOURCE/COMMENTS				
Lost and Stolen Fraud Reduction (Above PIN)	<p>Reduction in L&S Fraud Generated by PIN Compromise:</p> <table><tr><td>Chip Scenarios</td><td>10%</td></tr><tr><td>Mag-Stripe Scenarios</td><td>19%</td></tr></table>	Chip Scenarios	10%	Mag-Stripe Scenarios	19%	<p>Source: EDC</p> <p>Chip Scenarios: Because the Chip is programmed with transaction and cumulative value counters, a specified number of transactions will generate an on-line authorization regardless of floor limits. This results in</p> <ul style="list-style-type: none">• Elimination of most fraudulent transactions which exceed the Cardholder's credit limit (Pre and Post Status)• A reduction of some Post-Status fraud for transactions below the floor limit which would be authorized only as a result of the counters <p>Assumes "1 In N" counter with N = 2 . Therefore 50% reduction of Post-Status L&S fraud (on portion of fraud where PIN is not used or is compromised). Assume post-status represents 20% of all L&S fraud. Total reduction: 50% of 20% = 10%</p> <p>Mag-Stripe Scenarios: Because every transaction is checked on-line, assume 95% of Post-Status fraud (on portion of fraud where PIN is not used or is compromised) is eliminated with some reduction in Pre-Status fraud due to profiling</p> <p>Assume post-status represents 20% of all L&S fraud. Total reduction: 95% of 20% = 19%</p> <p>NOTE: In pre-status, PIN compromise situations, only profiling will reduce L&S losses (except for small savings in chip where card use is above cardholder credit limit). Due to high Base Case authorization levels and current profiling capabilities, assumed 0% reduction in Pre-Status fraud for both Chip and Mag-stripe scenarios</p>
Chip Scenarios	10%					
Mag-Stripe Scenarios	19%					

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CATEGORY	ASSUMPTION	SOURCE/COMMENTS
Card Not Received Fraud Reduction (Above PIN)	<p>Reduction in L&S Fraud Generated by PIN Compromise:</p> <p>Chip Scenarios 5.0%</p> <p>Mag-Stripe Scenarios 9.5%</p>	<p>Source: EDC</p> <p>Same assumptions and methodology as described on previous page for Group B (Lost & Stolen) fraud reductions. Single exception: post-status NRI fraud estimated at 10% instead of 20%</p> <p><u>Chip Scenarios:</u> Total reduction: 50% of 10% = 5.0%</p> <p><u>Mag-Stripe Scenarios:</u> Total reduction: 95% of 10% = 9.5%</p>
Fraud Risk Management Control Programs	<p>Maximum annual saving per card for reduction in Fraud Investigation costs and Chargeback Processing costs, as they relate to fraud chargebacks.</p> <p>\$0.516 per card, times the percent reduction in fraud from "do nothing" levels</p>	<p>Source: EDC</p> <p>Assumes that there will be a reduction in fraud investigation costs and chargeback processing costs because of lower fraud levels</p> <p>The \$0.516 represents the estimated variable portion of the annual cost per card for fraud investigations (2/3 of the total cost), and currently nothing for chargeback processing, for which we think the savings will be nominal</p> <p>The \$0.516 is the maximum possible savings, if fraud was reduced to close to zero. The model calculates, in each year, the actual percent reduction in fraud from "do nothing" levels and applies this percent as a factor to the maximum savings level</p> <p>NRI and Neural Networks are not included here because we have not made assumptions accounting for the impact these programs will have on base fraud levels</p> <p>Assume 80% of benefit accrues to Issuers, 20% to Acquirers</p>

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CATEGORY	ASSUMPTION	SOURCE/COMMENTS
Incremental Unit Costs - Processing		
Authorizations - Communications and Internal Bank Costs	11.3¢ combined Issuer and Acquirer cost, (Issuer telecom and 3rd party processor cost of 3.5¢ plus internal bank processing cost of 1.3¢ 6.5¢ weighted average Acquirer cost, assumes 88% electronic @ 2¢ each plus 12% voice @ 40¢ each)	Source: All authorization cost estimates based on EDC Cost studies. CAM/PIN verification costs from Europay chip study
Authorization - Domestic Switch Fee	Issuers = 3.7¢ (weighted average MCI switching fee of 2.2¢ on 100% of transactions plus \$2.50 per call referral for 0.6% of all transactions). Acquirers = 0.5¢	
Authorization - Cross-Border Switch Fee	EPSS international switching fee of 19.5¢. Applied to transactions requiring an international authorization	
Verify Txn Certificate (chip)	Zero	Assumes cost is nominal given that transaction certificates will be verified on an exception basis, e.g., repudiation cases
Verify CAM/PIN (mag-stripe)	Mag cam/cvm 1.69¢ (0.0130 Ecu) Mag cam only 0.84¢ (0.0065 Ecu)	Incremental cost to verify the transaction certificate generated in a chip environment

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CATEGORY	ASSUMPTION				SOURCE/COMMENTS
Unit Costs - Hardware and Cards	<u>CHIP CVM/CAM</u>	<u>CHIP CAM Only</u>	<u>Mag-stripe CVM/CAM</u>	<u>Mag-stripe CAM Only</u>	Source: P.A. Consulting (relayed through Tom McGrath, MasterCard); EDC estimates. 50% cost share with other card associations
POS Terminal - Retrofit	\$300	\$200	\$300	\$200	Retrofit existing POS terminal to accept the CAM or CAM/CVM
POS Terminal - New	\$150	\$50	\$150	\$50	Incremental cost to include CAM or CAM/CVM functionality in a new POS terminal
ATM - Retrofit	\$3,200	\$3,100	\$3,200	\$3,100	Retrofit existing ATM to accept the CAM or CAM/CVM
ATM - New	\$150	\$50	\$150	\$50	Incremental cost to include CAM or CAM/CVM functionality in a new ATM
Card - (CAM/CVM incremental only)	\$1.60 declining to \$1.00	\$1.60 declining to \$1.00	\$0.07	\$0.07	Incremental cost to incorporate CAM or CAM/CVM functionality onto a MasterCard (Chip cost includes chip, embedding and personalization)
Card - (Non CAM/CVM Reissue)	\$1.00				Normal reissue cost of a card in a non-CAM/CVM environment. (Applied as a savings when reissue cycle of cards is lengthened as a result of increased card durability from the chip). Source: EDC cost studies
ADMIN/SYSTEMS:					
1. Cardholder Education					Communications costs to educate and prepare Cardholders for new technology
	\$500k "mall road show" plus artwork for statement stuffers				"Security" mall show covers every major shopping area in the country every 3 months. Source: T. McGrath
	3 Statement stuffers @ \$0.25 each for all existing and new cardholders				Statement stuffers \$0.15 - \$0.25 each (Source: MCI). Assumed high-end: 3 stuffers @ \$0.25 each
	CAM only scenarios at 10% of above costs				Most costs are related to PIN. CAM is largely transparent to cardholder

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CATEGORY	ASSUMPTION	SOURCE/COMMENTS
ADMIN/SYSTEMS: 2. Retailer Education	<p>Cardboard POS standup instructions at about \$0.75 for each of 5-6 million merchants</p> <p>Assume \$5m to supply small retailers with POS training kits, \$10m for large retailer on-site training, and \$5m for retailer telephone support</p>	<p>Description: Communications and training costs to prepare Retailers for new technology, related to both CAM and PIN</p> <p>Source: MCI/T. McGrath. Cost to be shared with other card associations. Cost of artwork included as part of Cardholder education</p> <p>Source: EDC estimates</p> <p>MasterCard Internal costs are Included In Cardholder Education</p>
ADMIN/SYSTEMS: 3. MasterCard Staff Resources	<p>\$400k/year fully loaded, each year for all 7 years</p>	<p>Four incremental staff at MasterCard for technical, security and marketing functions</p> <ul style="list-style-type: none"> • One marketing (new opportunities) • One testing / quality control of chip • One public key management svcs (already have 1 person in St. Louis) • One operational / systems development support • No additional regional marketing staff
ADMIN/SYSTEMS: 4. Contingency Factor	<p>10% of total Administration & Systems costs, for the first three years</p>	<p>To cover unexpected expenditures</p>

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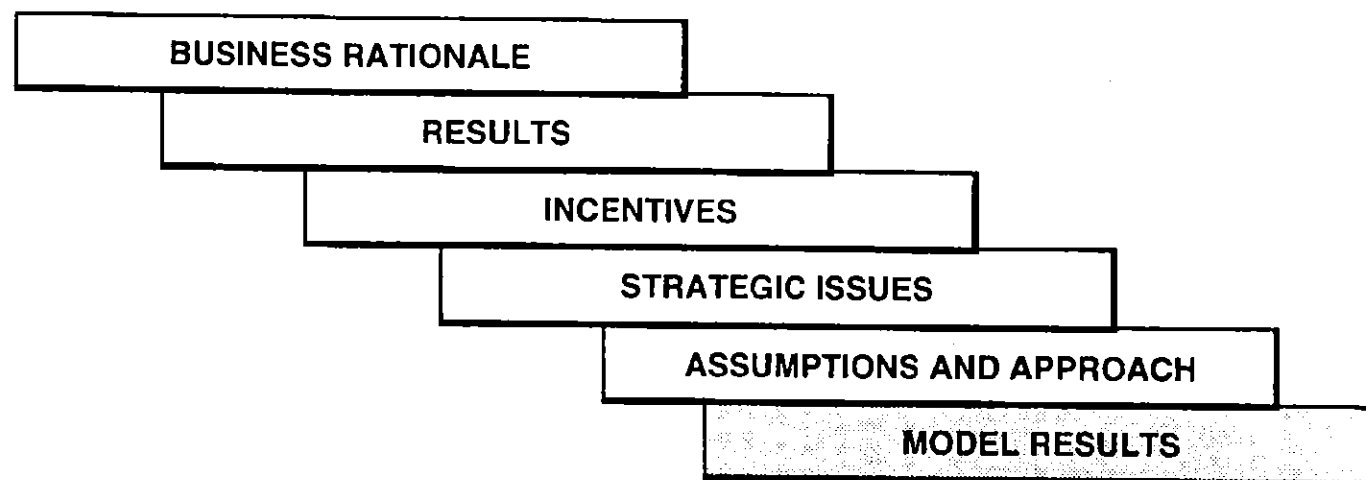
CATEGORY	ASSUMPTION	SOURCE/COMMENTS				
ADMIN/SYSTEMS: 5. Upgrade Retailer Systems/ Communications (Mag-Stripe Only)	<ul style="list-style-type: none">Security - Cost as yet undetermined; varies by retailerReliability - No extra cost. Systems already capable of 90-100% authorization volumesCapacity - No extra cost. Same reason as Reliability	<p>Cost to upgrade store controller networks in connection with Mag-Stripe scenarios</p> <ul style="list-style-type: none">Enhanced Security - To ensure secure end-to-end transmission of CVM/CAM (sending PAN and CAM values in the clear for verification at MCI or Issuer host)Reliability - Reducing down-time to minimize need for stand-in processingCapacity - For increased authorization traffic				
ADMIN/SYSTEMS: 6. OTHER SYSTEMS COSTS Mag-Stripe	<p style="text-align: center;"><u>Mag-Stripe</u></p> <table><tr><td>CAM/PIN</td><td>\$13 million</td></tr><tr><td>CAM Only</td><td>\$6 million</td></tr></table>	CAM/PIN	\$13 million	CAM Only	\$6 million	<ul style="list-style-type: none">Verification of Watermark value to allow MasterCard to provide stand-in processing (however, no requirement for MCI to maintain list of PINs)CAM & PIN verification at the Issuer hostKey management systems
CAM/PIN	\$13 million					
CAM Only	\$6 million					
CHIP	<p style="text-align: center;"><u>CHIP</u></p> <table><tr><td>CAM/PIN</td><td>\$39 million</td></tr><tr><td>CAM Only</td><td>\$19 million</td></tr></table>	CAM/PIN	\$39 million	CAM Only	\$19 million	<ul style="list-style-type: none">Personalization equipmentEnhance MasterCard, Acquirer, and Retailer systems to allow download of changes in Issuer-defined parameters to Cardholder's chip at the POSTransaction certificate verification by the IssuerKey management systems <p>Source: Partially based on French experience</p>
CAM/PIN	\$39 million					
CAM Only	\$19 million					

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CATEGORY	ASSUMPTION	SOURCE/COMMENTS
<p>Card Conversion Schedule</p> <p>% Cardholders Converted</p>	<p>% of total cardholder base converted to CAM or CAM/CVM cards by end of each year</p> <p>End of Year YR1 YR2 YR3 YR4 YR5 YR6 YR7</p> <p>% Converted/Yr 20% 42% 22% 7% 5% 4% 0%</p> <p>Cumulative 20% 62% 84% 91 96 100% 100%</p>	<p>Used MasterCard schedule, based on a mid-year 1994 launch and varying reissue cycles from 2 to 5 years. (Source: Tom McGrath)</p>
<p>Reissue Period in Implementation Scenario</p>	<p>2 years for all scenarios</p>	<p>Difficult to achieve 3 year life for chip card since cards would require a mag-stripe for use in non-chip environments</p>
<p>Reissue %</p>	<p>5% per year</p>	<p>% of cardholder base each year that requires a reissued card due to card fault or loss/theft of card</p>

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DETAILED BASE CASE RESULTS

FINANCIAL PAGE DIRECTLY FROM MODEL

FOR ALL 4 BASE CASE SCENARIOS

(CHANGE NUMBERING FROM 0,1,2,3 TO 1,2,3,4)